REMARKS

This is intended as a full and complete response to the Final Office Action mailed on November 16, 2004. Claims 1-11 were examined. The Examiner rejected claims 1-5 and 7-11 under 35 U.S.C. § 103(a) as being obvious in view of Mayer (U.S. Patent No. 5,526,454) in combination with Yanagawa (U.S. Patent No. 5,583,958) and claim 6 under 35 U.S.C. § 103(a) as being obvious in view of Mayer and Yanagawa in further combination with Itoh (U.S. Patent No. 6,115,515). For the reasons set forth below, Applicant respectfully traverses.

Invention Solves Long-Standing Problem in the Art

As the application makes clear, the present invention solves a problem that has existed in the prior art for several years. The background section of the application traces the history of transitioning from using copper connectors in circuit boards to using planar optical waveguide for data transmission. The background section describes the limitations of using copper connectors, such as parasitic inductances and capacitances in the copper paths and inefficiencies resulting from crosstalk, as well as the numerous problems encountered when attempts were made to use optical connections instead of copper. Specifically, researchers found that the losses associated with using planar waveguides were too high for backplane applications and that losses at planar waveguide crossings, due to crosstalk, were unacceptable. In addition, researchers found that glass and plastic fibers, although having very low losses, could not be used effectively when the wiring pattern required branches or connections. See Application at p. 3, line 33 – p. 5, line 10.

The present invention solves the problems encountered with optical connections by using both planar waveguides and fibers in the same optical waveguide structure. The optical

waveguide structure recited in claim 1 may be used effectively in electrical optical circuit boards for backplane applications. Electrical optical circuit board research dates back to the early-mid 1990s, predating both Mayer and Yanagawa, yet the problems discussed above and set forth in the background section of the application were not solved until Applicant conceived and reduced the present invention to practice – approximately 4 years after both Mayer and Yanagawa.

The Examiner argues that, since Yanagawa discloses fibers that cross each other for easier grouping of input/output optical fibers, modifying the device disclosed in Mayer to include fiber crossing portions would have been obvious to a person skilled in the art. On the contrary, the fact that such a design was not disclosed in the public domain at the time Applicant filed his application in Germany – four years after Mayer and Yanagawa – evidences that the design of the present invention was not obvious. Four years is quite long given that substantial research in the area of electrical optical circuit boards was being conducted in the latter half of the 1990s and that the semiconductor and optics industries have evolved tremendously over the past decade.

Yanagawa Teaches Away from Invention

The application explains that the claimed optical waveguide structure is comprised of fibers in the area of a crossing because planar waveguides were found to experience too much attenuation from crosstalk at crossings.

Figure 8 of Yanagawa discloses an optical waveguide pattern formed by combining a plurality of Y-branch waveguides that corresponds to a 2x4 star coupler. The disclosed pattern includes several optical waveguide intersection parts. The description of Figure 8 expressly states that "[a]t each of the intersections, optical waveguides cross each other at such a large angle that substantial loss or crosstalk will not occur." See Yanagawa at col. 10, lines 20-35.

Thus, even though Yanagawa discloses crossing optical fiber portions coupled to optical circuit chips, Yanagawa does not teach or make any suggestion whatsoever that optical fibers could be used at the crossings of the optical waveguide pattern of Figure 8. In fact, Yanagawa presents a completely different solution to the crosstalk problem associated with using planar waveguides at crossings – namely, designing the waveguides such that they cross one other at an angle large enough to prevent crosstalk from occurring. The foregoing shows that Yanagawa clearly teaches away from the solution of the present invention – using fibers at the crossings to avoid crosstalk.

In addition, the fact that the inventors in Yanagawa did not use fibers to address the crosstalk problem associated with using planar waveguides at crossings (especially when, as the Examiner has argued, Yanagawa discloses crossing optical fiber portions) completely undermines the Examiner's position, further evidencing that using fibers at crossings was not obvious to persons skilled in the art.

Yanagawa Does Not Constitute Analogous Art

Finally, Applicant resubmits that Yanagawa does not constitute analogous art and therefore was improperly relied on by the Examiner. First, Yanagawa is not in the same field of endeavor as Applicant's invention. The primary subject matter of the Applicant's invention is an optical waveguide structure that includes both planar optical waveguide branches and optical fiber crossings and provides low optical attenuation, including attenuation caused by crosstalk. See Application at p. 1, lines 11-14 and at p. 5, lines 30-36. By contrast, the subject matter of Yanagawa, though, is an optical device that can be used to build both single star and passive double star systems for connecting terminal equipment and office equipment on a network. See Yanagawa at col. 1, lines 6-10 ("[t]he present invention relates to an optical device . . . which is

applicable to both a single star system and a passive double star system"), at col. 1, lines 15-20 ("a single star system is known in which pieces of terminal equipment are connected to office equipment with use of optical fibers exclusively for respective terminal equipment") and at col. 1, lines 65-67 ("[a]lso, the passive double star system having a similar function is shown in Fig. 4"). Since the optical device taught by Yanagawa serves a completely different purpose than Applicant's optical waveguide structure, one skilled in the art would recognize these inventions to be in different fields of endeavor.

Second, Yanagawa is not at all relevant to the particular problem solved by Applicant's invention. The specification is clear that the Applicant's invention addresses certain limitations found in prior art optical waveguide structures used in circuit boards such as, for example, the high rate of attenuation associated with planar waveguides (see Application from p. 3, line 33 to p. 4, line 14), the crosstalk between planar waveguides (see Application p. 4, lines 16-32) and the lack of branching with optical fibers (see Application p. 5, lines 8-10). By contrast, Yanagawa provides an optical device that can be used in both single star and passive double star systems to address the cost and labor issues with constructing a single star system after constructing a passive double star system. See Yanagawa at col. 2, lines 27-42. As persons skilled in the art would recognize, the problem addressed by Yanagawa has no relation to the problem addressed by Applicant's invention.

In sum, Applicant contends that the Examiner has taken the crossing optical fiber portions disclosed in Yanagawa completely out of context and has misapplied that disclosure to the present invention. The Examiner argues that Yanagawa is in the same field of endeavor as the present invention since they both deal with optical wiring systems using planar waveguide substrates and optical fibers. However, an important difference is that the fibers disclosed in

Yanagawa are outside of the substrate, whereas the fibers disclosed in the present invention are at least partially inserted into the troughs of the substrate. This distinction is critical since, as described above, Yanagawa does not contemplate scaling down the disclosed crossing fiber portions and using them within the substrate.

CONCLUSION

Based on the foregoing, Applicant respectfully submits that claim 1 is in condition for allowance and requests the withdrawal of the § 103(a) rejection of this claim. Further, since claims 2-4 all depend on allowable claim 1, these claims also are in condition for allowance.

Independent claims 5 and 7 recite limitations similar to those described above in conjunction with claim 1. Applicant therefore respectfully submits that claims 5 and 7 are in condition for allowance for at least the same reasons as claim 1. Further, since claims 6 and 8-11 all depend from either allowable claim 5 or allowable claim 7, these claims also are in condition for allowance.

Having addressed all issues set out in the Office Action mailed on March 3, 2004, Applicant respectfully submits that the pending claims are in condition for allowance and requests that these claims be allowed. If the Examiner has any questions, please contact the Applicant's undersigned representative at the number provided below.

Respectfully submitted,

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